508.14 High Performance Waterproofing Membrane Lump Sum

SECTION 509 -STRUCTURAL PLATE PIPES, PIPE ARCHES, ARCHES, AND METAL BOX CULVERTS

509.01 Description This work shall consist of furnishing and installing structural plate pipes, pipe arches, arches, and metal box culverts in accordance with these specifications and in reasonably close conformity with the lines and grades shown in the Contract Documents.

509.02 Materials Material shall meet the requirements of the following Sections of Division 700 - Materials:

Asphalt Filler for Structural Plate Arches	702.09
Steel Structural Plate Pipe, Pipe Arches, Arches, Box Culverts and Fasteners	707.09
Aluminum Alloy Structural Plate Pipe, Pipe Arches, Arches, Box Culverts and Fasteners	707.14

509.03 Fabrication Structural plate pipes shall be circular with a vertical elongation of approximately 5% unless otherwise specified on the Plans.

Plates shall be formed to provide lap joints for bolted assembly. Joints shall be staggered so that no more than three plates come together at one point.

Bolt holes shall be made so that all plates having like dimension, curvature and the same number of bolts per meter [bolts/ft] of seam shall be interchangeable. Each plate shall be curved, before assembly, to the radius necessary to produce the final cross section called for.

End plates shall be neatly cut to the skew and slope shown on the Plans. Burnt edges shall be free of oxide and burrs, and shall be completely galvanized. Special plates and part plates shall be legibly marked to correspond to markings on an erection/assembly diagram, which shall be furnished by the Contractor. The Contractor shall prepare and submit Shop Drawings, erection/assembly diagrams, or other necessary Working Drawings in accordance with Section 105.7. These drawings will be reviewed and approved in accordance Section 105.7.

Bolt holes along those edges of the plates that will form longitudinal seams in the finished structure shall be staggered in 2 rows, 50 mm [2 in] apart for steel structural plates and shall be in 2 rows, 44 mm [1¾ in] apart for aluminum structural plates. Holes shall be in the valley and crest of the corrugations. Bolt holes along those edges of the plates that will form circumferential seams in the finished structure shall be no more that 300 mm [12 in] apart. The distance from the center of a hole to the edge of the plate shall not be less than 2 times the diameter of the bolt. The nominal diameter of the bolt holes, not including corner holes in the longitudinal seam, shall be 3 mm [• in] greater that the diameter of the bolts.

509.06 General Excavation for the structure and for the bedding material shall be in conformance with Section 206 - Structural Excavation.

Structures shall be assembled in the sequence and manner recommended by the manufacturer, and in such a way that no distortion of plates would occur. Bolts of the manufacturer's recommended length shall be used in all holes. Nuts shall be tightened to 275 N-m [200 ft/lb] plus or minus 125 N-m [100 ft/lb] of torque. Aluminum nuts, used with aluminum structural plate structures, shall be tightened to 170 N-m [125 ft/lb] plus or minus 13.5 N-m [10 ft/lb] of torque. Any nuts loosened by subsequent procedures shall be retightened.

The Contractor shall provide the Resident with a calibrated torque wrench for use during construction. The Contractor shall provide proof to the Resident that the torque wrench has been calibrated within the past six months.

Steel plates or accessory materials on which the zinc metallic coating has been burned by welding or has otherwise been damaged in fabrication or handling shall be repaired in the field. The Resident shall determine if repairs are needed to the coating and will mark the areas to be repaired. The damaged areas shall be cleaned to bright metal by blast cleaning, power disk sanding, or wire brushing. The cleaned areas shall extend 13 mm [½ in] into the undamaged section of the coating. The cleaned areas shall be coated within 24 hours of the cleaning using an approved zinc-rich paint. The zinc-rich paint shall be applied to a dry film thickness of at least 0.013 mm [0.005 in] over the damaged sections and surrounding cleaned areas.

The Contractor shall maintain a minimum cover of 1 m [3 ft] over the top of the structure where construction equipment is used or traffic is maintained.

509.07 Structural Plate Pipes and Pipe Arches The use of cofferdams and dewatering of the stream will not be a

requirement for the installation of pipes and pipe arches unless otherwise specified in the Contract Documents. Prior to placing the structure or any plates, the bed shall be brought to the required line and grade and shaped to its required section as much as practicable. When practicable, the pipe or pipe arch shall be moved back and forth longitudinally on the bedding material to shape and compact the bedding material prior to releasing the structure in its final position. The bedding material and structure shall not be placed at times of high water. The Contractor shall obtain approval before placing the bedding material and the structure.

The specified bedding material may be omitted if the existing material under the pipe is suitable.

When not otherwise specified in the Contract Documents, backfill shall be a selected material of a granular nature with a minimum of clay. It shall contain no frozen material, vegetable matter nor anything that will not pass through a 75 mm [3 in] square opening screen. The 75 mm [3 in] size limitation shall not apply to areas 1.5 m [5 ft] or more from the structure.

Fill material shall be deposited evenly on both sides of the structure in layers not exceeding 150 mm [6 in] in depth, loose measure, until the three-quarter point is reached. It shall be thoroughly compacted under the pipe or pipe arch on both sides of the structure. Above the three-quarter point, fill layers shall not exceed a depth of 200 mm [8 in], loose measure. Backfilling and compacting shall be done in the presence of the Resident.

509.08 Structural Plate Arches Structural plate arches shall be anchored to concrete substructure by unbalanced channels, as shown on the Plans. When erection is complete and before any backfilling is done, the spaces between the structural plates and the legs of the unbalanced channels, on both sides, shall be completely filled with asphalt filler. Aluminum channels used with aluminum structural plate structures shall not be in direct contact with concrete. An appropriate material, approved by the Resident, shall be used between the aluminum channel and the concrete.

When backfilling arches before headwalls are built, a narrow ramp of backfill material shall be built up evenly at each side of the arch and midway between its ends until a minimum cover of 1 m [3 ft] over the top of the arch is reached. The backfill material used in the ramps shall be thoroughly compacted as it is placed. The remainder of the backfill shall be deposited from the top of the ramp, both ways from the center toward the ends as evenly as possible on the sides of the arch.

If the headwalls are built before the arch is backfilled, the same procedure as above shall be followed, except that the backfill material shall first be placed in the form of a narrow ramp adjacent to one headwall. When the aforementioned

height above the arch is reached, the backfill material shall be deposited from the top of the ramp toward the other headwall.

In all cases the filling material shall be thoroughly, but not excessively, compacted. Compacting the backfill by means of flooding or ponding the material with water will not be permitted.

509.10 Structural Plate Box Culverts Box culverts shall be assembled in accordance with the shop drawings provided by the manufacturer and per the manufacturer's recommendations. The box culverts shall be installed in accordance with the Contract Documents and the manufacturer's recommendations. End treatments and the type of invert and/or foundation shall be as indicated on the Plans. The Contractor shall use caution during backfilling operations so that any anchor rods attached to the headwalls and wingwalls are not damaged.

Structural plate box culverts on concrete substructures shall be anchored to the substructure by unbalanced channels as shown on the Plans. When erection is complete and before any backfilling is done, the spaces between the structural plates and the legs of the unbalanced channels, on both sides, shall be completely filled with asphalt filler. Aluminum channels used with aluminum structural plate structures shall not be in direct contact with concrete. An appropriate material approved by the Resident shall be used between the aluminum channel and the concrete.

509.11 Method of Measurement Structural plate pipe, pipe arches, arches and plate box culverts will be measured as one lump sum.

509.12 Basis of Payment The accepted structure will be paid for at the respective Contract lump sum price, which price shall include full compensation for preparation of the bed for pipes and pipe arches; the asphalt filler and unbalanced channel for arches; the horizontal end reinforcing ribs for aluminum alloy structural plate pipe and pipe arches; the headwalls, wingwalls, toewalls, full metal invert and/or footing pads for metal box culverts; anchor bolts imbedded in concrete; the receiving channels for metal box culverts on concrete substructures; and all incidental items required to complete the work, including the calibrated torque wrench for use by the Resident.

Reinforced concrete headwalls and wingwalls are not included for payment under this item.

Whenever the minimum cover material extends above the subgrade line, the removal of the material which is necessary to complete the work in accordance with the Plans will be measured and paid for as Common Excavation as provided in

Section 203 - Excavation and Embankment.

Payment will be made under:

Pay Item		Pay Unit
509.11	Structural Plate Pipe	Lump Sum
509.12	Steel Structural Plate Pipe Arch	Lump Sum
509.13	Steel Structural Plate Arch	Lump Sum
509.141	Steel Structural Plate Box Culvert	Lump Sum
509.18	Structural Plate Pipe	Lump Sum
509.19	Aluminum Alloy Structural Plate Pipe Arch	Lump Sum
509.20	Aluminum Alloy Structural Plate Arch	Lump Sum
509.21	Structural Plate Pipe (Steel or Aluminum Alloy Option)	Lump Sum
509.411	Aluminum Structural Plate Box Culvert	Lump Sum

SECTION 510 - SPECIAL DETOURS

510.01 Description This work shall consist of the design, construction, maintenance in good condition, and removal of temporary structures and approaches required for the satisfactory maintenance of vehicular and pedestrian traffic.

Easements or right-of-way for the Special Detour will be furnished by the Department and will be shown on the contract plans. The Contractor may obtain additional easements at no cost to the Department.

510.02 Materials Materials used for the Special Detour structure and approaches shall be approved by the Resident before they are incorporated in the structure and approaches.

510.03 Vehicular and Pedestrian Traffic Not Separated The Special Detour shall be located as close as practicable to the new work or as shown on the plans.